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COMMITTEE ON THE PEACEFUL
USES OF OUTER SPACE

REPORT ON THE UNITED NATIONS/EUROPEAN SPACE AGENCY SYMPOSIUM ON SPACE TECHNOLOGY FOR IMPROVING LIFE ON EARTH, CO-SPONSORED BY THE COMMISSION OF THE EUROPEAN COMMUNITIES, THE EUROPEAN SPACE AGENCY AND THE GOVERNMENT OF AUSTRIA

(Graz, Austria, 11-14 September 1995)

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INTRODUCTION

A. Background and objectives

1. As part of the 1995 activities of the United Nations Programme on Space Applications of the Office for Outer Space Affairs of the United Nations, a Symposium entitled "Space Technology for Improving Life on Earth" was jointly organized at Graz, Austria, by the United Nations and the Government of Austria. The Symposium, serving as a follow-up to the Workshop entitled "Enhancing Social, Economic and Environmental Security Through Space Technology" held at Graz in 1994, was designed to build on the experience gained during that Workshop. The Symposium was hosted by the Federal Ministry for Foreign Affairs of Austria and co-sponsored by the State of Styria, the City of Graz, the European Space Agency (ESA) and the Commission of the European Communities.

2. The main objective of the Symposium was to promote the use of space technology to improve living and economic conditions in developing countries. In that regard, the meeting focused primarily on policy and management issues involved in national, regional and international space programmes, and on how those issues related to the exploitation of space technology for sustainable development, taking into account the social and economic conditions of the developing countries concerned.

3. Through presentations and panel discussions, the Symposium addressed key areas of concern identified by the 1994 Workshop, placed emphasis on matching existing and expected space capabilities with existing and foreseen needs for those capabilities, and sought to identify ways to involve high-level policy and decision makers in developing countries in making use of space technologies in support of national development plans and programmes.

4. Recommendations were made on how to convince policy and decision makers in developing countries that space systems could contribute to social and economic security. That was accomplished primarily by addressing the problems caused by insufficient information in the areas of education, environmental monitoring, management of natural resources and disaster warning, mitigation and prevention.

5. The present report was prepared for the Committee on the Peaceful Uses of Outer Space and its Scientific and Technical Subcommittee. Participants were expected to report to the relevant authorities in their countries.

B. Programme

6. Presentations delivered during the Symposium addressed the issue of how satellite remote sensing and satellite communications could provide accurate and timely information considered to be essential for policy formulation and effective decision-making in developing countries. Presentations also covered case-studies and pilot projects on the use of satellite technology to enhance food security, education and health, and to upgrade communications infrastructure and disaster early warning systems.

7. Throughout the Symposium, actions were identified that could convince high-level policy and decision makers in developing countries of the costs and benefits inherent in the use of well-chosen applications of space technology for sustainable development.

8. International and national institutions that were actively involved in space activities were invited to present an overview of programmes and specific applications in which cooperative activities with institutions from developing countries could be undertaken. Some institutions from developing countries identified areas where their countries were or could be utilizing space technology to assist in formulating policy or implementing management decisions concerning, *inter alia*, sustainable exploitation of natural resources and preservation of the environment.

C. Participants

9. The United Nations invited developing countries to nominate candidates to participate in the Symposium. Participants from the countries concerned held positions in institutions or private industry dealing with resource management, protection of the environment, communications, remote sensing systems, industrial and technological development and other fields related to the themes of the Symposium. The participants were also selected because of their work in programmes, projects and enterprises in which space technology could be utilized.

10. Policy makers, at decision-making levels from both national and international entities, were also invited. They were asked to highlight, in their presentations, the key issues that would persuade them to place a higher priority on the operational implementation of space applications.

11. Funds allocated by the United Nations, ESA, the Commission of the European Communities and the Government of Austria were used to cover the travel cost and per diem expenses of participants from developing countries.

12. The following Member States and international organizations were represented at the Symposium: Bahrain, Brazil, Cambodia, Chile, China, Colombia, Egypt, Ghana, India, Iran (Islamic Republic of), Jordan, Kenya, Lebanon, Malawi, Malaysia, Mexico, Nicaragua, Pakistan, Peru, Philippines, Russian Federation, Senegal, Sierra Leone, Sri Lanka, Thailand, Uganda, United Republic of Tanzania, Venezuela, Viet Nam, and Zimbabwe; Office for Outer Space Affairs, International Telecommunication Union (ITU) and World Meteorological Organization (WMO); and Commission of the European Communities, ESA, International Astronautical Federation (IAF), Inter-American Development Bank and International Space University (ISU). Speakers, chairmen, panellists and participants from Austria, Belgium, Canada, France, Germany, Italy, United Kingdom of Great Britain and Northern Ireland and the United States of America also contributed to the success of the meeting.

I. PRESENTATIONS AND DISCUSSIONS DURING THE SYMPOSIUM

A. General themes

13. Presentations made during the course of the Symposium focused on how national and international space agencies should implement, in cooperation with developing countries, pilot projects to demonstrate the usefulness of space technology to policy makers. As transnational industrial cooperation had become an important factor in shaping the character of space activities throughout the world, emphasis was also placed on increasing cooperation across national borders among private companies.

14. The global concern for the environment and sustainable development had led countries to cooperate further and make available a wider range of space-based technologies and know-how to other countries. It was noted, however, that many policy issues remained to be addressed if space technology was to be further developed in the light of current world economic constraints. Areas that required such policy review included financing, technology transfer, data dissemination, national, regional and international cooperation, institutional arrangements and national security.

15. Within the next 35 years, the world population would increase by 50 per cent, from about 6 billion in 1995 to about 9 billion in 2030. Food production would therefore have to be increased, requiring a more efficient management of natural resources. Participants agreed that the information technologies of remote sensing and geographical information systems (GIS) would play a vital role in meeting those requirements.

16. Presentations also focused on human-induced environmental changes, particularly in developing countries, such as deforestation, which had had a dramatic impact on food production, supplies of fuel wood and fodder, soil fertility and water resources. In terms of improving forest management, it was noted that one of the primary measures to be implemented was the development of techniques that would provide rapid and accurate information about forest conditions. In that regard, emphasis was placed on one solution that had become operational, involving information generated by the synoptic coverage provided by Earth observation satellites. Participants agreed that only by using data from such satellites would it be possible to monitor and quantify forest resources when whole countries or continents were involved.

B. Earth observation for sustainable development

17. In the field of Earth observation for sustainable development, WMO had developed a policy and practice for the international exchange of meteorological data and products. The new policy included the free and unrestricted exchange of meteorological data essential for meteorological and hydrological services. It also met the requirements of data and information exchange of several international conventions such as the United Nations Framework Convention for Climate Change (A/AC.237/18 (Part II)/Add.1 and Corr.1, annex I) and the International Convention to Combat Natural Disasters.

18. With regard to education and training in satellite applications, the strategy adopted by WMO for satellite operators participating in the WMO Global Observing System (GOS) was to cooperate with at least one of its specialized satellite applications training centres located around the globe. In response to that policy, the Council of the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) had recently decided to co-sponsor two training centres in Africa.

19. Participants agreed that the utilization of Earth observation satellite data in developing countries still needed to be increased. In that context, the representative of ESA noted that it would focus on areas in which improvements were essential for successful projects based on remote sensing for sustainable development. Those areas included ensuring the continuity of remote sensing data from satellite operators, technical assistance in the implementation and operation of ground stations, price reductions and easier access to data, provision of training and education for efficient and timely data processing and analysis, and increased efforts in the coordination of programmes and projects between national, regional and international aid agencies.

20. Currently, ESA systems of European remote sensing satellites (ERS), known as ERS-1 and ERS-2, provided developing countries in particular with repetitive and continued environmental monitoring. ERS data were provided free of charge to selected scientific research groups or entities involved in operational applications. In the near future, the ESA satellites ENVISAT-1 and METOP-1, under a joint project with EUMETSAT, were scheduled to be launched.

21. Scientific and technological cooperation between developing countries and the Commission of the European Communities was becoming an increasingly important and comprehensive activity with regard to the transfer of technology and knowledge. In that context, the Commission had launched a study entitled "Analysis of the constraints and opportunities for cost-effective implementation of Earth observation techniques in developing countries". The overall objective of the study was to facilitate decisions on future European investments in space technology applications by providing an assessment of potential opportunities in developing countries for remote sensing of Earth.

22. A major Canadian initiative, which would have a significant impact on global resource management, land use and vegetation monitoring, was discussed. It involved the development of the applications-oriented Earth remote sensing satellite RADARSAT, along with a synthetic aperture radar (SAR) system as its remote sensing payload. In addition to the SAR all-weather, day and night recording capability of the Earth surface,

RADARSAT would have a truly global monitoring capacity, as its on-board SAR data recorders would record and store data in a format compatible with most ground stations.

23. The Food and Agriculture Organization of the United Nations (FAO) was currently starting to implement a new project, the Africa Land Cover Map and Digital Geographic Database (AFRICOVER), for production of a digital geographic database and associated thematic map of land use and vegetation cover of the entire African continent. The first phase of the AFRICOVER project was being implemented in East Africa. The map of the entire continent would be produced at scales of 1:250,000 and 1:1,000,000. It was noted that the overall objective of AFRICOVER was to provide African decision makers, regional and international development agencies and United Nations organizations with reliable information on current land use and vegetation cover.

24. It was noted that the sector of environmental resource management was an activity that involved a well-defined user community. That community required specific tools and data types for a wide variety of activities, from data acquisition to decision-making and control. In that context, the GEOMANAGEMENT project was presented as an umbrella concept for typical management practices in the sector. It was noted that the project would use geo-referenced data and information as the basis for its programmes.

25. GEOMANAGEMENT programmes and projects at international, national and local levels should be defined on the basis of a clear definition of priority issues. Agenda 21, the action plan adopted by the United Nations Conference on Environment and Development, held at Rio de Janeiro, Brazil, from 3 to 14 June 1992,[1] would serve as a basis for identifying national priorities in dealing with issues such as industrial pollution, waste management, land use and allocation, deforestation and the exploitation of renewable resources. In that connection, activities that could improve the operational use of space technology were the establishment of local receiving stations, increased accessibility to environmental data and the stimulation of data sharing between international, regional and national organizations and agencies.

26. In 1993, FAO and the United Nations Environment Programme (UNEP), in close cooperation with the Economic and Social Commission for Asia and the Pacific (ESCAP), initiated the Operational Low-Cost Integrated Vital Information Access (OLIVIA) programme, a long-term regional environmental programme aimed at the development and application of information technologies for natural resources and environmental management in the Asia and Pacific region. The OLIVIA programme would support and strengthen cooperative decision-making relevant to sustainable environmental and natural resources management in agriculture, forestry and fisheries in the Asia and Pacific region, with particular emphasis on standardized and harmonized data and information exchange between interregional programmes.

27. In many developing countries, remote sensing and GIS were increasingly being used for mapping natural resources and hazard management. A presentation by India on its remote sensing-based pilot project at the village level was made during the Symposium. Applying cost-effective remote sensing techniques, land and water resources were identified in order to map the "basic integrated land and water resource units" in the Anantapur district, located in the south-west of the State of Andhra Pradesh. Detailed mapping of natural resources on a scale of 1:50,000 had been undertaken, using data from the Information Retrieval Service (IRS) remote sensing satellite of India, known as IRS-1A. The various scientific recommendations made on the basis of analyses of remote sensing data were validated in the field by several rural exercises.

28. On the basis of the encouraging results of the pilot study carried out in the Anantapur district, a nationwide project entitled "Integrated mission for sustainable development" had been launched in 172 districts spread over the whole country. Those districts, frequently affected by droughts and floods and covering 45 per cent of the geographical area of India, were currently being extensively surveyed from outer space through the use of satellite remote sensing systems.

29. In the case of Malaysia, it was noted that the national meteorological agency, whose major role was to provide weather and meteorological services, was strongly supported by satellite remote sensing data. It had been demonstrated that remote sensing from space platforms had contributed significantly to the advancement of meteorology, and in particular to a better understanding of tropical weather systems, as a means for improving weather-related disaster warning and response.

30. The Malaysian Meteorological Service operated a ground-based synoptic observation network to monitor weather, atmospheric and environmental conditions. That organization depended heavily on space platform observations for the purpose of early warning of weather-related disasters such as floods and typhoons. The dependency on space-based observing systems was a direct outcome of the excellent spatial coverage provided by those systems.

31. In Brazil, enormous amounts of biomass had been burned for fuel production and to clean the soil for cattle grazing and other agricultural uses. Recent satellite images of the Amazon region had dramatically shown deforestation patterns, especially in the States of Para, Rondônia and Maranhão. Currently, the Brazilian Institute for Space Research (INPE), with other national and international institutions, was studying the Amazon region using both ground-based and satellite remote sensing data. The satellite systems that had been used included ERS-1 and ERS-2, the Japanese Earth Resources Satellite (JERS-1), LANDSAT, the shuttle imaging radar (SIR-C) and the Experimental Earth Observation System (SPOT). Through the use of space remote sensing systems, worldwide awareness of ongoing deforestation in the Amazon region was growing, and national policy and decision makers were becoming convinced of the need to react to such dramatic changes, which were degrading the regional environment and had serious implications for the global climate.

32. In Zimbabwe, the Famine Early Warning System (FEWS), a donor-supported programme, used the advanced very-high-resolution radiometer (AVHRR) satellite system to produce crop assessments during the growing season. The FEWS programme provided only an indication, but not a sufficiently early indication, of drought and its sequences. It was therefore essential for the FEWS programme to be reviewed and improved in order to make it more effective as a tool for the mitigation of droughts.

C. Space communications and disaster management

33. The spread of electronic telecommunications had surpassed the expectations of many experts. In the United States, an estimated 9 million individuals telecommuted at least one or two days per week. The nearly 18 million subscribers using cellular devices in the United States were a key part of the phenomena. Many professionals such as attorneys and accountants extended their workday by some two hours via mobile communications.

34. A growing number of workers in countries and areas such as Barbados, India, Jamaica, Republic of Korea and Taiwan Province of China were telecommunicating to other countries such as the United States and Japan. The wireless office for travelling professionals and mobile workers of all kinds seemed to be an almost inevitable trend, as the global economy increasingly shifted from agricultural and industrial employment to service-based employment dependent upon information and data rather than physical resources and specific locations.

35. Participants agreed that truly broad-band, high-quality and completely mobile services via satellite opened up a host of new possibilities and opportunities. The participants noted some of those options which were becoming more accessible and cost-effective, including electronic tutors and telehealth units that could reach anywhere on Earth, flexible telecommunications services (both mobile and fixed) for home and business, wireless offices and extraterritorial networks. In developing countries in particular, such options could be faster, more flexible and lower in cost.

36. The satellite communications industry had recently developed a concept using millimetre wave frequencies as a practical bandwidth for communications satellites. For the first time, a proposal had been made for the use of low Earth orbit satellites to provide cost-effective and continuous services to rural and remote areas in parts of the developing world that lacked sufficient infrastructure.

37. ITU played a vital role in assisting developing countries in improving their communications infrastructure. Special emphasis was placed on improving communications networks for remote and rural areas of developing countries through the use of satellite-based communications services. Networks could develop incrementally without government involvement. Furthermore, only a few local engineers would be needed to focus on limited tasks. Network extensions would be relatively low-cost, and could be funded by private sources.

38. There was no doubt that rural telecommunications could basically be profitable. The main reason why so little money and time was invested seemed to be the high initial start-up cost and the expectation that a long time would be needed to reach the financial break-even point. The cost of a conventional phone in a rural area during its first year was roughly $5,000. The average purchase price for a hand-held satellite phone was approximately $1,000. The lower initial investment could therefore significantly boost the availability of telecommunications in the rural areas of developing countries. The impact would be increased by the fact that satellite phones could be easily redeployed, whereas conventional installations were more or less fixed.

39. In pursuing its mandate, ITU developed the Spacecom project to promote the use of satellite communications systems in rural and remote areas of developing countries. The project was intended to provide industry with a realistic assessment of the requirements for satellite communications in rural and remote areas, to identify constraints, to propose viable solutions and to elaborate pilot projects. It was organized so that the project sponsors (mostly international organizations and industries from developed countries) would constitute the decision-making body. Regulatory and operating authorities in developing countries were invited to participate in the decision-making body, and ITU provided the implementation framework.

40. Given the typical characteristics of rural areas, such as sparseness of population, lack of trained personnel, low initial demand and high costs of installing individual services, it was suggested that the introduction of enhanced information exchange in rural areas of Africa should be achieved through the establishment of telecentres where services would be pooled to serve the entire community. The telecentres would be located in a central village and offer a range of services depending on local needs.

41. The telecentres would contribute both directly and indirectly to economic, social, cultural and political development of rural areas by facilitating government administration and services, including those relevant to agriculture, rural education and health, development of economic activities and disaster mitigation efforts.

42. Several European countries recently agreed to jointly finance a satellite-based telecommunications system called MERCURE, for the benefit of the United Nations Environment Programme (UNEP). In that context, a cooperative information network, known as the COPINE proposal, linking scientists, educators and professionals in Africa, was prepared by OOSA in close consultation with the secretariat of the MERCURE Governing Board. Twelve countries had been targeted as implementation sites for the COPINE project: Botswana, Cameroon, Ethiopia, Ghana, Kenya, Morocco, Nigeria, Senegal, South Africa, Tunisia, United Republic of Tanzania and Zimbabwe. They had been selected mainly on the basis of their needs and their perceived capacity to provide the necessary physical and governmental environment that would allow the project to be successfully implemented and sustained. That implied, among other criteria, a recognition by the Governments concerned of the important role that modern information technologies could play in advancing national development, and other local developments relating to information exchange which could enhance the eventual usefulness of COPINE.

43. The priority application areas selected for networks using COPINE were discussed, including health care, management of natural resources and the environment, tele-education, and the exchange of scientific and technical information. In general, COPINE would facilitate five types of data transmission: interactive audio, image and video transmissions; large computer files on the order of 100 megabytes; interactive data transfers such as on-line database searching; scanned documents; and voice communications.

44. In Mexico, a seismic alert system for Mexico City had been operating as an experimental evaluation project since 1991. The aim of the project was to mitigate the effects of earthquakes generated in the Guerrero Gap. There was an average early-warning time advantage of 60 seconds before an earthquake occurring on the Guerrero Coast would strike Mexico City, some 320 kilometres away. The system consisted of four parts: a seismic detection system, a dual telecommunications system, a central control system and a radio warning system for the public.

45. Civil government authorities, who sponsored the project, had made considerable efforts to increase earthquake preparedness. One of the most important objectives of the civil government authorities was to achieve a high reliability level of the early-warning seismic system. The real-time UHF/VHF radio communications system may therefore be complemented with satellite communications systems, enhancing communications between field stations and the public, and also increasing the geographical coverage of Mexico.

II. OBSERVATIONS AND RECOMMENDATIONS

A. General themes

46. During the course of the Symposium participants re-emphasized the vital role of space technology in improving human conditions in developing countries. To make progress in further benefiting from such potential, solutions had to be found to several policy issues and their related technical challenges. Participants noted that one of the most important solutions was the continued availability of satellite systems in support of social, economic and environmental development.

47. Participants emphasized the importance of demonstrating the cost-effectiveness of using space technology for the implementation of high-priority projects identified by Governments in national programmes for sustainable development.

48. Assuming that its cost-effectiveness was assured, bilateral and multilateral development and funding agencies as well as international organizations should increasingly incorporate the use of space technology in the design and formulation of development projects at national and regional levels.

49. Regional and international organizations dealing with social and economic development issues should increase their cooperation in order to assist developing countries in incorporating space applications into their national programmes. The organizations specifically targeted included the Asian Development Bank, the Commission of the European Communities, ESA, UNEP, United Nations Development Programme (UNDP), FAO, World Health Organization (WHO), World Bank and WMO.

50. Participants reiterated that remote sensing and GIS technologies would play a vital role in filling the information gap in developing countries with regard to the current state of their natural resources, land use and impact of natural disasters. It was emphasized that some developing countries would need short-term assistance in the provision of such information to their decision makers when needed, and long-term assistance in strengthening their national capacities to be able to generate such information in an effective and timely manner.

51. Participants agreed that efforts should be undertaken to promote the use of space technology through the mass media, thus emphasizing the achievements of space technology and its applications, in an easily comprehensible manner at different educational levels using newly available equipment such as personal computers, CD-ROMs or other inexpensive ground receiving stations. Furthermore, space technology curricula relating to national programmes for sustainable development in developing countries should be introduced through universities.

52. Developed countries should continue to assist developing countries in implementing space technology for national development plans and programmes. In that context, it was stressed that the establishment of regional and national education and training centres for space technology would play a vital role.

53. Industry participation and sufficient infrastructure were also mentioned as areas of vital importance in the successful incorporation of space projects into national programmes. If no proper policy was implemented, then the role of industry would be restricted to that of short-term contractors rather than equal partners in space applications. In India, an infrastructure of 400 local industries as partners in the Indian national space programme had been created, on the assumption that industrial competitiveness provided the assurance of high-quality service. In that context, participants discussed the possibility of other developing countries following the example of India in developing an industrial infrastructure contributing to national space programmes.

54. However, it was stated that in most developing countries, private sector involvement in space technology applications was still negligible. National organizations and agencies should therefore seek ways and means of introducing space technology for sustainable development into the private sector. Furthermore, non-governmental organizations should be involved in the application of space technology to various economic sectors where savings could be made.

55. Every country intending to profit from space technology should appoint some form of national focal point to act as a coordinator and disseminator of information both within the country concerned and within other countries and international organizations and agencies. It was deemed to be a priority task to demonstrate to national decision makers that providing funds to space applications for sustainable development would pay off.

56. Specialists from developing countries stressed the need for increased standardization of satellite data, and the Committee of Earth Observation Satellites was urged to continue to give attention to that matter.

B. Earth observation for sustainable development

57. Satellite remote sensing capabilities were increasingly being built into environmental monitoring units within ministries for environmental protection. While that was a significant improvement regarding the use of satellite remote sensing as a tool for policy- and decision-making, ministries in many developing countries were still constrained by the lack of funds and of executive responsibility. In that context, the need for improved access to inexpensive remote sensing data in a standardized format on a continuous basis was stressed.

58. Remote sensing technologies had been developed mainly in developed countries. Developing countries had sought to incorporate those technologies into their development plans and programmes, yet most developing countries were still not prepared to implement remote sensing programmes because of the high cost of remote sensing data, limited manpower and funding resources and a lack of organizational structures.

59. Participants repeatedly emphasized that remote sensing and GIS were valuable tools for resource managers and policy makers concerned with the preservation of the environment and national development plans. Despite technological advances, decreasing costs and increasing "user-friendliness", the potential

offered by those technologies had not yet been fully assessed or realized. Further investigations were therefore needed to assess the costs and benefits associated with remote sensing applications.

60. Sufficient training and education possibilities were critical for successfully incorporating remote sensing and GIS technologies into national development plans. Training was required at a variety of levels and in a number of forms, from one-day to one-week seminars for senior resource management personnel to two-week to three-month training classes for advanced technical personnel, to university degree training at undergraduate and graduate levels. Given the importance of training, it was noted that a number of regional and international organizations and agencies offered various training programmes. Despite those efforts, however, the lack of trained personnel in developing countries continued to be a critical constraint on the full exploitation of remote sensing and GIS for developmental purposes.

C. Space communications and disaster management

61. The relationship between access to information and level of income was already strong and becoming stronger both within and among countries. The information revolution threatened to increase inequities, but it also provided tools to reduce poverty. Improved access to education, health care and environmental information was increasingly available to developing countries because of recent developments in information technology. Rural and poor urban communities could be integrated into economic life, and thereby raise their income levels through information services.

62. The end-user should be the focal point of all serious attempts to develop successful new satellite communications services. Planners should tailor the range and mobility of the service requirements to respond to those challenges, and map technologies to meet the needs of the end-user.

63. In the future, the design, development and deployment of user-friendly satellites should be given the highest priority in the design and deployment of national, regional and international information infrastructures.

64. In developing new applications software and customer-specific systems for health, education, training, telecommuting and further relevant social services, the United Nations and its Member States should strengthen their leadership role. An entity such as ISU, for example, could be petitioned to compile a global database of all satellite and fibre optic systems currently in operation. Once created, such a database could be interactively assessed by worldwide health and education organizations to determine how those systems could be made available for low cost tele-education, telehealth and telemedicine services.

65. There had been several recent successful efforts among international funding agencies to study possible applications of telecommunications technology and to implement projects in developing countries. The University of the West Indies Distance Teaching Experiment, the Indonesian Distance Education Satellite System, and the Peruvian Rural Communications Services Project currently included 25 conference sites and reached thousands of university students, teachers, doctors, nurses, health-care workers and researchers. With the improved skills, greater knowledge and up-to-date information afforded by those programmes, the recipients of training were better able to support national development plans. Moreover, the programmes could be used as models for future training efforts.

Notes

[1] *Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992* (A/CONF.151/26/Rev.1 (Vol. I and Vol. I/Corr.1, Vol. II, Vol. III and Vol. III/Corr.1)) (United Nations publication, Sales No. E.93.I.8 and corrigenda), vol. I: *Resolutions adopted by the Conference*, resolution 1, annex II.

Annex

PROGRAMME OF THE SYMPOSIUM

Date/Time	*Subject*	*Speaker/Country Organization*
Monday, 11 September 1995		
	Space applications for improving the human condition	
0830-0900	Registration	
0900-1015	Opening ceremony:	
	Opening and welcoming statements	United Nations Governor of Styria, Mayor of Graz, Austrian Ministry for Foreign Affairs, Austrian Ministry for Science, Research and Arts
1015-1045	Theme address: The potential of space technology to improve the human condition - a policy and technological challenge	G.O.P Obasi, Director General (WMO)
1045-1100	**Break**	
1100-1130	The contribution of ESA's programmes to sustainable development in developing countries	G. Duchossois (ESA)
1130-1200	Cost-effective remote sensing systems in support of sustainable development in developing countries	D. Vassaux (Commission of the European Communities)
1200-1230	Use of space technology to enhance food security and economic stability in developing countries	Z. Kalensky (Canada)
1230-1415	**Lunch**	
1415-1445	The contribution of satellite systems to the communications infrastructure in developing countries	W. Richter (ITU)
1445-1515	The role of satellite communications in the information highway	J. N. Pelton (United States of America)

Date/Time	*Subject*	*Speaker/Country Organization*
1515-1545	Establishing national policy and infrastructure for utilization of space technology in developing countries	S. Mehmud (Pakistan)
1545-1600	**Break**	
1600-1800	First panel discussion The role of decision makers in the realization of space projects in the developing world (followed by general discussion)	

Tuesday, 12 September 1995

Implementation of space projects for sustainable development

0900-0930	GEOMANAGEMENT - implementing space programmes in support of sustainable exploitation of natural resources and preservation of the environment	O. Cogels (Belgium)
0930-1000	Institutional aspects of managing space programmes of national concern in developing countries	S. Zaman (Pakistan)
1000-1015	**Break**	
1015-1045	Improving industrial infrastructure and involvement of local industry: an essential need for successful space programmes	M. Rao (India)
1045-1115	Management of space projects - planning and implementing	N. F. Sanko (Russian Federation)
1115-1215	Brief presentations by developing-country participants on the theme of the session	
1215-1400	**Lunch**	
1400-1430	Managing small-scale space projects in developing countries - challenges and problems	C. H. Matarira (Zimbabwe)
1430-1530	Planning and managing remote-sensing-based projects at the village level - case-study of the Anantapur project	B. Kripanandam, R. S. Rao (India)

Date/Time	*Subject*	*Speaker/Country Organization*
1530-1545	**Break**	
1545-1730	Second panel discussion Space systems in support of sustainable development - sharing experience among developing countries (followed by general discussion)	
Wednesday, 13 September 1995		
	Space communications and disaster management - benefits through appropriate use of space systems	
0900-0930	Satellite video conferencing and very small aperture terminals networks in support of improving the communications infrastructure in developing countries	O. Koudelka (Austria)
0930-1000	Enhancing quality of life through distance education	D. Piaggesi (Italy), H. Landazuri (United States)
1000-1015	**Break**	
1015-1045	COPINE Project: a cooperative information network linking scientists, educators and professionals in Africa	H. George (United Nations)
1045-1230	Brief presentations by developing-country participants on the theme of the session	
1230-1415	**Lunch**	
1415-1445	Disaster warning, prevention and mitigation - technological and organizational efforts	W. K. Kong (Malaysia)
1445-1515	The Mexico City seismic alert system: operation and results	J. M. Espinosa (Mexico)
1515-1530	**Break**	
1530-1730	Third panel discussion Combating natural disasters - the value of space systems to decision-making entities (followed by general discussion)	

Date/Time	*Subject*	*Speaker/Country Organization*
Thursday, 14 September 1995		
	Space technology facing the challenges of the twenty-first century	
0900-0930	Earth observation from space: current and future applications	S. Saradet (Germany)
0930-1000	The human impact on the environment - possibilities to combat environmental damages, including the use of space technology	A. Moreau (Venezuela)
1000-1015	**Break**	
1015-1245	Presentations of Chairmen of the technical sessions and general discussion to prepare report	
1245-1415	**Lunch**	
1415-1445	Satellite image data in support of monitoring forest degradation	C. Hoffmann (Commission of the European Communities)
1445-1515	Long-term effects of biomass Burning to terrestrial ecosystems - current state and future perspectives	L. A. Vieira Dias (Brazil)
1515-1545	Education for youth and promotion of space technology as a tool for rational management of the Earth	M. Bernard (France)
1545-1600	**Break**	
1600-1630	Summary of the Symposium: accomplishments and review of possible follow-up actions	S. Mehmud (Pakistan)
1630-1730	Final discussion and adoption of report	
1730	Closing ceremony	